

Indian Amateur Astronomer R. G. Chandra:

A unique AAVSO member

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Abstract. In this Note, which is a sequel on the Indian amateur astronomer R.G. Chandra [Biswas et al. 2011a,Biswas et al. 2011b], we have presented some documents to reveal his three-decades relationship with the American Association for Variable Stars Observers and other connection to American astronomical societies. We have given a short account of his observations on different category, viz. (i) Variable stars, (ii) Nova, (iii) Meteors and (iv) Andromedae. His responsibilities and recognitions are also discussed.

1 Introduction

Radha Gobinda Chandra (henceforth Chandra), a petty clerk of Treasury Office of Jessore, received international recognition as an amateur astronomer through his sheer love for astronomy and meticulous observations. A detailed account of his life and works can be found in the study of Biswas et al. [Biswas et al. 2011a]. Chandra was a member of the American Association of Variable Star Observers (AAVSO) and regularly communicated his observational findings to AAVSO. The main motivation of the present work is to highlight the role of Chandra as a responsible member of AAVSO as well as reveal some new findings which were not covered in the aforementioned paper.

From the Eastern India, Chandra was the lone observer and member of the AAVSO, to report his observational data, during the period of early 20th century. He was an avid observer of the variable stars along with the cosmic events like the eclipses, cometary apparitions, meteor falls etc. His excellent estimations on the brightness of variable stars were of immense importance to the contemporary professionals of the West, in particular of the America, for the study of some physical characteristics of the stars.

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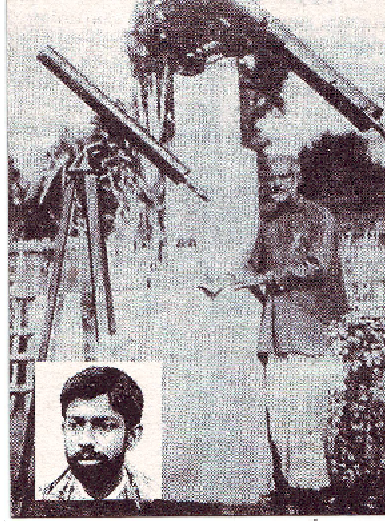


Fig. 1. Photograph of aged R.G. Chandra working with his 3 and 6 inches refracting telescopes along with a photograph of young Chandra (inset) [Reproduced from Ref. [Biswas et al. 2011a]]

2 Early Attachment with AAVSO

It is now a well known fact that due to his ignorance of technicalities, Chandra missed the glory of being the discoverer of Nova Aquilae 1918 [Biswas et al. 2011a]. The report sent by Chandra about his observation of Nova Aquilae reached Charles Pickering (1846-1919) six months after its first reporting. Although, by the time, significance of the report had faded out from the professional astronomers' point of view, yet the said report drew considerable attention of Pickering who promptly realized the potentiality of Chandra as a good observer. Accordingly, on 14 November 1918 he dispatched an inspiring letter accompanied by a few valuable books, star map, Revised Harvard Photometry and some literatures on the Nova Aquilae. He also made necessary arrangement for enlisting Chandra as a member of the AAVSO, in recognition of his ability equal to the standard of international observers. But it should be mentioned here that even before Chandra sent his 'report' on the 'new star' (i.e. Nova Aquilae) to Pickering, he made communication with the AAVSO by expressing his intension to take part in the process of estimating variables. This point becomes evident from a part of the letter dated 8 July 1918, written by S.I. Belly [Campbell 1932a], on behalf of the AAVSO:

"Situating as you are six hours East of Greenwich, your station should prove of great help in the observation of these variables ..."

Since 1919 Chandra could contribute his data collected from the observation of variable stars to the journal of several learned societies of Europe and America. In connection to the AAVSO history Part-4: 'The AAVSO and International Cooperation' it has been reported in the AAVSO portal, for the members between 1911 and 1921, that *"Other early international observers were: Radha G. Chandra of Bagchar, India, who made over 49,700 observations ..."*. So, probably Chandra became the member of AAVSO around the year 1919.

3 AAVSO Telescope

Due to his advantageous location of observation and quality of estimation of magnitude of variables, Chandra's reports earned immense importance from the professionals for their studies on the physical characteristics of stars. In order to receive better reports on fainter variables, the authorities of AAVSO were contemplating to lend him a more powerful telescope. Accordingly Leon Campbell, the Chairman of its Telescope Committee, informed Chandra about their intension of lending him a $6\frac{1}{4}$ -inch refractor through the following letter:

HARVARD COLLEGE OBSERVATORY CAMBRIDGE, MAS

*Mr. R. G. Chandra
Bagchar,
Jessore P.O. India*

August 12, 1924.

My Dear Mr. Chandra,

For a long time I have been very desirous of securing for you the use of a larger telescope than you have. At last this seems about to be realized. Our patron and friend Mr. C. W. Elmer of N.Y. has just turned over to the Association his $6\frac{1}{4}$ lens in tube with finder and ocular and cradle clamps for attaching the tube to a mounting. The lens is very good one and should enable one to see much fainter stars than with a three inch instrument.

Now if you can see your way clear to provide some sort of mounting, either temporary or permanent, the telescope committee is willing to let you have the loan of this splendid equipment as described above.

... Just how to best arrange for such a loan is the serious question. As long as you live and will keep the instrument in reasonable use for AAVSO, variable star observing, the telescope can be considered as virtually yours. The difficulty comes in the case of your death. What assure can be had that the equipment would be restored to the Association, either to some other observer in Asia, Europe or U.S.A.? This is what bothers us. The equipment is valued at 500 dollars and as long as you keep it in good use, we shall feel well repaid for our efforts in lending to you.

I might suggest that you own three inch would make a very desirable additional finder, especially if you have no circles at first. The Association could defray the initial cost of transportation, asking you to repay the Association as you could.

If you decide that the loan of this equipment is practical, that you can provide some sort of mounting for the present at least and will agree to use it exclusively for AAVSO observing, will take good care of it, and reimburse the Association later for the transportation expenses and provide for its return to the Association or it authorized agent upon your demise or inability to make further use of it, let me know and I'll start steps for having it sent to you at once.

With best wishes and kindest regards, I am,

Faithfully yours

*Leon Campbell
Chairman Telescope Committee.*

As the mounting, together with the said telescope reached Bagchar in damaged condition in the year 1926, Chandra had to repair the mounting before he began to use the $6\frac{1}{4}$ -inch from 1928.

4 Chandra as an AAVSO-Observer

4.1 Observation of Variable Stars

The data of instant brightness collected from the systematic observations of variable stars enable astronomers to reveal several physical characteristics, viz., the mass, radius, temperature, luminosity, composition, both the internal and external structures and evolution of the stars. In order to achieve a more reliable result, these data are required to be collected in sufficient quantity from various stations scattered at far and wide distances all over the globe. In this regard, there were good numbers of variable star observers contemporary to Chandra, from Europe and America on the Western longitudes, but not sufficient on the Eastern side to report their estimations on variables to the AAVSO. From India Chandra [Campbell 1925] of Jessore, Bengal ($23^{\circ} 10'N$, $89^{\circ} 10'E$), George E. Jones [Chakrabarty 1999] of Mussoorie, U.P. ($30^{\circ} 27'N$, $78^{\circ} 06'E$) and M. K. Bappu [Campbell 1926] of Begampeth, Hyderabad ($17^{\circ} 10'N$, $70^{\circ} 20'E$) were the only three to contribute 'estimates' to the said Association, since 1919, 1924 and around 1927 respectively.

Leon Campbell (1881-1951) was elected President of AAVSO in 1919, the year from which Chandra began to report his estimations on variables to the same at regular intervals. Thus in the process of serving the 'Association' by these two astronomers in different roles from the opposite hemispheres of the Earth for years together, both Campbell and Chandra were in close contact until the former died in 1951.

The quality of work done by Chandra can be realized from the remark made in a letter [Campbell 1926], dated 20 June 1922, addressed to him by Harlow Shapley (1885-1972), Director of the Harvard College Observatory:

"May I add a personal word of congratulation for the good work you have been doing in the observation of long period variable stars. Your longitude is of considerable importance in this work."

The available data reported by Chandra to the AAVSO and subsequently published in its Monthly Reports, reveal how much laborious and ardent he was as an observer of the 'Association'. For instance, during Campbell's tenure as Recording Secretary of AAVSO, Chandra's month-wise reporting of estimates of the brightness of a total of 1685 variable stars was the largest among such number in any single year ending October 1926. Though analysis of the said 'Report' of the actual number of estimations recorded by observing Julian day-wise shows that Chandra made 1682 estimations on about 160 variables, during the year ending September 1926 [Campbell 1926] [see Table-1]. Although Chandra himself made highest number of 247 estimations in the month of January 1926, yet he was lauded later as one of the three major contributors of reports on variables to the AAVSO. As such Campbell as the Recording Secretary, while publishing those reports sent by 25 observers who made 1358 estimations on 313 stars for the month of April 1926, in the Monthly Report of the AAVSO [Campbell 1932a] made the following comments on 12 May 1926:

"Most commendable list have been received the past month from Messrs Peltier, Chandra and Waterfield, their combined records totaling more than half the number of all the observations combined therein."

Table 1. The highest number of estimates made by Chandra on the variables in any single year ending October 1926

Months	Julian Day	Observed no. of Stars	No. of actual estimation	No. of obs. reported
1925 Oct	2424 424-455	67	118	-
Nov	456-485	109	193	105
Dec	486-516	108	169	223
1926 Jan	517-547	115	247	178
Feb	548-575	109	220	162
Mar	576-606	76	185	226
Apr	607-636	87	169	175
May	637-667	49	81	-
Jun	668-697	53	77	312
Jul	698-728	52	74	-
Aug	729-759	59	87	139
Sep	760-789	48	62	83
1926 Oct	790-820	-	-	82
TOTAL			1982	1685

In the month of April 1926, L.C. Peltier, R.G. Chandra and W.F. H. Waterfield reported 259, 175 and 237 estimations respectively. Actually, total of these estimations are not ‘more than half’ but ‘very nearly equal to the half’ of the number 1358¹.

Thus Chandra had been reporting his estimates on variables in the journals of AAVSO, BAA, de L’Observatoire de Lyon etc. and gradually his excellence of work was also waxing with confidence. Within a few years he became a competent and indispensable member in the observational astronomy. In course of time, he was contemplating to observe fainter stars of higher magnitudes than those were capable to view through his 3-inch refractor. At the same time, he came in contact with J. H. Logan of Dallas, Texas who began to report his ‘estimates’ probably from October 1926 to the AAVSO as its member and was in possession of an 11-inch telescope for his observation [Campbell 1928]. In reply to some queries of Chandra which include the size of telescope required for viewing the stars of higher magnitudes, Logan sent a long correspondence [Hoffleit 1942]. From this correspondence, the answer related to information of the size of telescope, is given below:

“You asked me about the size of telescope necessary to see stars to the 16th or 17th magnitudes. There is a formula which can determine this:

$$\text{Log aperture in inches} \times 5 + 9.2'' \quad (1)$$

The formula (1) implies that the faintest star can be viewed:

(a) through his 3-inch is of $\text{Log } 3 \times 5 + 9.2$ or 11.59 mag, and (b) through the 6 $\frac{1}{4}$ -inch lent to Chandra by the AAVSO, is of $\text{Log } 6.25 \times 5 + 9.2$ or 13.18 mag. Due to such variations in the capabilities of different sizes of instruments Chandra could not view the faint stars beyond the 12.6 magnitude through his 3-inch refractor. But with the lending of the 6 $\frac{1}{4}$ -inch refractor from the AAVSO he could now detect faint stars up to 14.1 magnitudes [see Table-2].

¹ Interested readers may consult the ANNEXURE I [Bandyopadhyay & Chakrabarty 1991] for some of the contributions on Variable Stars by Chandra in Annual and Monthly Reports of AAVSO (1920-21)

Table 2. The magnitude of some of the most faint stars Chandra observed: (A) Prior to and (B) Post acquisition of $6\frac{1}{4}$ -inch telescope

	Observed magnitude	Stars	Date of observation		Report to AAVSO	
			Julian Day	Gregorian Day	Year	Page
A	12.6	185032 RX LYRAE	242 2984	21 Oct 1921	1922	20
	12.5	190925 S LYRAE	3613	12 Jul 1923	1923	98
	12.4	050492 U ORIONIS	4262	21 Apr 1925	1925	93
	12.3	163264 R DRACONIS	3315	17 Sep 1923	1923	07
	12.1	180531 T HERCULIS	2960	27 Sep 1921	1922	08
B	14.1	074922 U GEMINORUM	5649	06 Feb 1929	1929	54
	14.0	042209 R TAURI	6712	05 Jan 1932	1932	50
	14.0	060547 SS AURIGAE	5622	10 Jan 1929	1929	44
	13.7	190967 U DRACONIS	5448	20 Jul 1928	1928	81
	13.5	004746a RV CASSIOPEIAE	6635	20 Oct 1931	1932	02

The AAVSO authorities, in particular, Leon Campbell never missed any opportunity to accord appreciation for any worthy work of Chandra for the advancement of observational astronomy. In one such occasion, while reporting contributions of members of the AAVSO for the year ending October 1932, Campbell [Campbell 1932b] highlighted the work of a few including Chandra out of 80 observers from various parts of the globe:

“Of the 33000 observations, 21000 were contributed by 10 observers. Of these ten, Peltier heads the list with slightly over 4,000 observations, Jones is a close second, and Lacchini comes third. Next in order are Ahnert of Germany, Chandra of India, Baldwin of Australia, and Ensor of South Africa.”

Actually, Chandra reported 1655 estimations, including the highest number of 487 estimations in a single month of March, during that period.

Due to World War II, during the periods September 1939 - September 1945, many astronomers were on war duty and could not continue their observations. At such crucial time Chandra played an important role for the cause of observational astronomy. How nicely he discharged his responsibilities, can be revealed from the following ‘News Notes’ published by Dorrit Hoffleit [Hoffleit 1942], in the Sky and Telescope under the title ‘Variable Star Observations from India’:

“The Recorder of the American Association of Variable Star Observers, Leon Campbell, reports that the observations of variable stars have continued to flow in from India, despite the difficulties and delay in transportation, and despite the great menace of the war. He has received large number of estimates of the brightness of variable stars from R.G. Chandra, of Bagchar, about every six months”

We would like to hear on this particular issue of war-affected period from Campbell himself [Campbell 1946]:

“R.G. Chandra of Bagchar, India, has been an observer since 1920, with more than 30,000 observations to his credit. Here again, the war greatly interfered with his work during the past five years.”

Some time prior to August 1945, M. K. Bappu was in need of the service of a telescope. As a genuine astronomer Chandra, at the request of Campbell, gladly agreed to lend his 3-inch telescope to Bappu. For this generous act Bappu conveyed his thanks to Chandra through the following letter:

Begampet

14th August, '45

Dear Mr. Chandra,

It is very kind of you to offer me the loan of your 3" Refractor with its accessories so as to enable me to continue my observations of variable stars and I thank you heartily for the same. I am also grateful to Prof. Campbell for kindly recommending me to you. But I am sorry I cannot avail your generous offer immediately. As I intend going to Malabar during the first week of September and do not expect to be back before December, I do not think it will serve any purpose if I request you to send it to me now only. As soon as I return I will write to you.

Of course will meet all the charges required for its dispatch, and after it reaches me safe here I shall hold myself responsible for maintaining its condition and its safe return to you in time. The risk of loss or damage in transit, I believe even in this time, will be bore by the Railway, if article is properly packed and adequately insured. However I hope by the time I return and request you to send me the telescope, normal condition will prevail and the danger of the transit damage in transport will disappear.

In the mean time I will learn for how much you will insure the parcel so that I may have an idea what custom duty I shall have to pay on the article at this end. This information will also help me to correspond with the authorities for an exemption from custom duty as the instrument is coming only on loan and not going to remain here permanently. The Govt. charge 5 p.c. custom duty on all articles imported.

Once again thanking you heartily,

I remain

Sincerely Yours,

M. K. Bappu

Also, Campbell expressed his thanks to Chandra for complying with his request through the letter given below:

HARVARD COLLEGE OBSERVATORY CAMBRIDGE, MASS

Mr. R.G.Chandra
Bagchar, Jessore P.O., India.

February 2, 1946

Dear Mr. Chandra,

It is certainly generous of you to place on loan to Mr. Bappu the three inch telescope, and I thank you on behalf of the Association, as well as on my behalf. Mr. Bappu was an excellent observer when he had access to a large telescope, and I am looking forward to future. You might be interested to know that his son is also very much interested in variable star observing, and to date he has been contributing observations made with the naked eye. Now things are getting back to normal, I am anticipating

the receipt of more observations from your section of the country, especially so in view of the fact that we are approaching the time when one-millionth observation, as made by AAVSO, will be contributed before June first. Perhaps you may be proved to be the one who makes that one-millionth observation. Time only can tell. With kindest personal regards, and best wishes for your continued success, and ever mindful of the long record which you have made in the matter of observing variables for the AAVSO,

I am,

Very sincerely yours,

Leon Campbell
Recorder, AAVSO.

In the same letter Campbell wished Chandra to be able for making the one-millionth observation on a variable star. However, in the long run the one-millionth observation was achieved not by Chandra but Jocelyn R. Gill in April 1946 [Hoffleit 1946].

4.2 Observation of Nova

As an assiduous observer Chandra had observed a few novae besides his detection of the *Nova Aquilae* 1918 or *V 603 Aquilae* as its first observer. His ignorance about the formalities related to discovery of a celestial object deprived him from the glory of Nova discovery. The incident inspired him to continue for searching of a nova. When Campbell came to know about his effort, he wrote Chandra some encouraging words in a letter on 16 June 1921:

“You have taken up nova search in a good spirit and I hope you may be rewarded some day with a real Nova discovery.”

Along with the usual observation on variables he also estimated the brightness of 184300 *Nova Aquilae* in the year 1918. It has been found in the *Monthly Report* of the AAVSO for the years 1921, 1922, 1925 and 1926 that during the period of two years from September 1921, Chandra made 15 estimations (Table-3) [Eaton 1922] and that of from September 1924, he made 19 estimations on the brightness of the Nova. From these it is found that the brightness of the Nova, estimated during the period of two years from September 1921, were slightly fluctuating in between 9.00 mag and 10.3 mag, whereas those for the next succeeding years remained almost steady at about 10.4 mag which is close to its normal brightness of 10.5 mag. Perhaps Chandra was able to observe the transition stage of the Nova, before it declined to its minimum brightness at steady state.

Another famous nova of the 20th century, *Nova Hercules* 1934 or *DQ Hercules* [Campbell 1925] was discovered by a British amateur astronomer Prentice on 13 December 1934 [Struve et al. 1962]. However, from the text of Campbell’s letter, it is apparent that Chandra observed the nova DQ Hercules to oscillate in its postnova stage and the same phenomena continued for a long time. The letter, dated 29 March 1935, written by Campbell is as follows:

“I am pleased to acknowledge your postal card of the 16th Jny., concerning the first estimates of Nova Hercules. I am glad to note that you have kept watch on this star and have secured such a continuous series of observations. The fluctuations noted

Table 3. The brightness of the Nova V 603 Aquilae estimated by Chandra during the period from September 1921 to September 1923

Julian Day	Gregorian Day	Magnitude
242 2940.2	1921, Sep 07	9.0
2984.0	Oct 21	9.3
3016.0	Nov 22	9.2
3142.5	1922, Mar 28	9.4
3178.4	May 03	9.9
3196.2	May 21	10.0
3238.2	Jul 02	10.0
3292.2	Aug 25	10.0
3312.2	Sep 14	9.9
3339.1	Oct 11	9.7
3341.1	Oct 13	9.6
3563.5	1923, May 23	10.2
3608.1	Jul 07	10.2
3643.1	Aug 11	10.3
3677.2	Sep 14	10.3

in the star certainly been real and these have not ceased even up to present time.”

We also notice about Chandra’s observation from another source [Mayall 1963] report:

“In the early morning hours of December 13, 1934, a nova of magnitude 3.3 was discovered visually by J.P.M. Prentice, an English amateur. It was also discovered independently by three members of the A.A.V.S.O.: Leslie Peltier, who was travelling in Arkansas; R.G. Chandra in Bagchar, India; and Margaret Harwood, in Nantucket, Massachusetts”.

4.3 Observation of Meteors

That Chandra also was a competent meteor observer can be revealed from the response to one of his report on such observation sent to the American Meteor Society, Lede McCormick Observatory, University of Virginia. In reply, from the Headquarters of the ‘Society’, dated 5 February 1926, not only his excellent observations were appreciated but also he was invited to join the said Society, in the following words:

“Your note enclosing to excellent observations of telescope meteors reached me today As you are evidently a real worker in astronomy, how would you like to join the Am. Meteor Society?”

In a letter, dated 23 June 1927, Willard J. Fisher [Chandra 1985] of the Harvard College Observatory (H.C.O.) Cambridge, Massachusetts wanted to know from Chandra about the recorded knowledge of ancient Indians on the Leonid meteors. From a paper published by Hubert A. Newton [Newton 1865], Fisher found such knowledge from the countries like China, Arab and Europe, except India. He was sure about the fact that such wonderful celestial event cannot evade the knowledge of ancient Indians. In spite of his best effort, Chandra was sorry for not being able to not reply the quarries of his request. Yet, Chandra sent him about the incidents of meteor falls

and cometary apparitions available in the Indian epics, Mahabharata and Ramayana. In the case of another letter by Chandra of dated 7 September 1927, containing some reports on the Indian records of shooting star shower, Fisher gladly replied on 3 October 1927 as follows:

“Dear Mr. Chandra,

I have yours about Indian records of shooting star shower, dated Sept. 7, for which I am greatly obliged. I must confess to a very complete ignorance of the astronomical literature to which you refer, and I learn for the first time about the ruling motions for the study of astronomy in ancient in India.

I am certainly pleased that you are willing to take further trouble with regard to these matters. Could you not work up the result of your search, negative results as well as positive, into a paper? Such a paper would be welcome, I am sure, and I have no doubt that a place for its publication could be found, in India, or failing that here in this country.

Yours very truly,

Willard Fisher.”

From available records, it is found that Chandra reported on his successful observation of 24 meteors during 1928-30 and another 9 in 1937. Also, the following report on his observations of 22 meteors was published by Charles P. Oliver in 1931 [Oliver 1931]:

“We have also received, too late for last years’ report, observation of 17 telescopic and 5 casual meteors by R. G. Chandra of Jessore, India.”

4.4 Observation of Andromedae

It is a surprising information that Chandra even observed Andromeda by using his 3 and 6 inches refracting telescopes. The record is in the paper written by J. van der Bilt. It was published in the very prestigious and authentic British journal ‘Monthly Notices of the Royal Astronomical Society’ with the title ‘The light-variation of $V22 = SV\textit{Andromedae}$ ’ [van der Bilt 1934]. In the Introductory part of the paper it has been mentioned by Bilt that -

“From the list of A.A.V.S.O. observers I have omitted the names of those who have contributed only a single observation. As to the others I consider it a matter of courtesy not to treat them anonymously, but to give a list of their names and particulars about their instruments; especially since it appears that the mean deviation of the estimates of these observers (taken as a group) from the final light-curve does not differ appreciably from that of my own estimates”.

From this statement about the list of the AAVSO-observers (see Table 4) it is clear that Chandra other than a single observation contributed lots of data on Andromedae. Also it is obvious from Bilt’s remarks that Chandra’s observational data and hence the estimates on mean deviation from the final light-curve were comparable to the other World-class observers including the author of the paper himself.

TABLE I
List of A.A.V.S.O. Observers

Abbr.	Name	Residence	Instrument
An	H. Ancanari	Faenza, Italy	3" refr., 8" refl.
B	T. C. H. Bouton	St. Petersburg, Fla. ; Hudson, N.H.	6" refr., 7" refl.
Ba	H. C. Bancroft	W. Collingswood, N.J.	5" refr.
Be	D. Benini	Faenza, Italy	3" refr., 8" refl.
Bi	L. Berman	Minneapolis, Minn.	15" refr.
Br	D. F. Brocchi	Seattle, Wash.	10" refl.
Bw	H. W. Bigelow	Northampton, Mass.	3" refr., 11" refr.
Ch	R. G. Chandra	Bagchar Jessore, Br. India	3" refr., 6" refr.
Cy	M. Cilley	Brooklyn, N.Y. ; Romney, Va.	5½" refr.
De	W. J. Delmhorst	Jersey City, N.J.	4" refr.
Hu	W. Houston	Madison, Wisc.	4" refr.
Ie	N. Iedema	Great Neck, Long Island, N.Y.	10" refl.
Jk	Miss L. Jenkins	Mt. Holyoke Coll., So. Hadley, Mass.	8" refr.
Jo	E. H. Jones	Somerville, Mass. ; Goffstown, N.H.	3, 5 and 6" refr.
Kz	C. Kurtz	Bethlehem, Pa.	11" refl.
Lg	J. H. Logan	New York City ; Dallas, Tex.	3, 4 and 12" refr.
Lv	F. P. Leavenworth	Minneapolis, Minn.	15" refr.
M	C. Y. McAteer	Pittsburgh, Pa.	4" refr., 5" refr.
Md	R. E. Millard	Portland, Oregon	4" refr.
Mg	O. E. Monnig	Fort Worth, Tex.	4" refr., 11" refl.
Pi	D. B. Pickering	East Orange, N.J.	3½" refr., 5" refr.
Pt	L. C. Peltier	Delphos, Ohio	2, 4 and 6" refr.
Y	A. S. Young	Mt. Holyoke Coll., So. Hadley, Mass.	8" refr.

2. The material from which I have derived a homogeneous and fairly continuous representation of the star's behaviour between 1912 and 1934 consists of the following observations :—

Name	Instrument	Number of Observations	Reference
Butterworth	6" refr.	783	<i>Bull. Lyon ; Bull. Ass. Fr. Obs. Etoiles var.</i>
A.A.V.S.O.	Various instruments	461	<i>P.A. (various vols.).</i>
van der Bilt	3", 4½" and 10" refr.	214	<i>J.d.O., 15, 118.</i>

The total number of observations is 1458, embracing an interval of 7985 days. There is a gap of 195 days between J.D. 241 9484 and 241 9679. From the latter date on the observations are continuous ; this is shown by Table II, which contains for 10 consecutive intervals of about two years the total number of observations (n) and the mean frequency (m) per 30 days.

The number of observations per month, required for a reliable light-curve of a 300 days' period, may be considered to be 3 or 4. In Table II the mean value of m is 5.7 ; that is to say, the points are evenly distributed

5 A Responsible Person

We see a Variable Star Notes from the AAVSO by Campbell [Campbell 1936] as follows:

“... we are glad to welcome back to the ranks of active observers Mr. R.G. Chandra, of Bagchar, India, who, because of ill health, has been forced to take a vacation of several months from observing.”

So, as Chandra became incapacitated to perform any kind of intellectual activities, he on the advice of AAVSO authorities, handed over the 6 $\frac{1}{4}$ -inch refractor to M. K. Vainu Bappu (1927-82), in 1958. The said telescope has been installed at the entrance of Vainu Bappu Observatory at Kavalur (78⁰ 49.6'E, 12⁰ 34.6'N, Altitude - 725 m) in the North Arcot district of Tamil Nadu India, under the direct supervision of the IIA. This handing over of the telescope shows Chandra's sense of responsibility towards astronomy. This dutifulness prompted him not to keep the equipment in his own custody when he was unable to make proper use of it.

Apart from observation of celestial objects, Chandra was a keen reader of astronomical journals, including the *Sky and Telescope*. After reading its March, 1951, issue, he became curious about the origin of naming the days in a week. In order to know about the 'origin of naming', he wrote the following letter to the Editor of that journal and it was published in its January 1952, issue:

“Sir,

In terminology Talks, March, 1951, under ‘The Week’, I read ‘we readily recognize the planetary origin of the names ...

But was there any reason, cause, or rule to arrange the names of the days in alternate order of one outer and one inner planet? For example, after Moon, Dies Lunie, the outer Planet Marsis taken for Dies Martis, the inner planet Mercury is for Dies Mercurii, then the outer planet Jupiter for Dies Jovis. Venus was taken for Dies Veneris and next Saturn as Dies Saturni. The Moon is the inner bright orb at new Moon and the outer on at full Moon, therefore I assume Dies Lunae after Solis. But for the others? I shall be glad if anybody could find out the cause.

R.G.CHANDRA

*Sarkarbari,
P.O. Sukchar,
Dist. 24 Pargana,
India (West Bengal).*

In response, Chandra received a brief reply in March 1952, issue from Edgar W.Woolard of Washington D.C. given below:

“The names of the seven planets of the ancient were attached to the 24 hours of the day as ruler of these hours, in order of descending distance from the Earth in the ancient Greek geocentric system; the planet that rule the first hour was the ruler of the day and the day was named after this planet.”

M.W. Mayall made report in the *Popular Astronomy* [Mayall 1951] about the contribution by Chandra with his ill health even in 1951. We note from the Table 5 that he made 73 observations with 93 estimates.

Variable Stars

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is 0^m4 east and $5'$ north of the 8.4 comparison star of S Camelopardalis. Its approximate 1900 position is $5^h 35^m$, $+68^\circ 50'$, and it is probably a new variable. The observed range is from 9.5 to 10.8 magnitude.

Observations received during April, 1951: A total of 4,866 observations was received during the month from the following 66 observers:

Observer	No. Var.	No. Ests.	Observer	No. Var.	No. Ests.
Adams, R. M.	45	130	Lacchini, G. B.	9	9
Ahnert, P.	30	194	Leutenegger, E.	22	69
Ancarani, M.	14	26	LeVaux, H. A.	106	106
Armfield, L. E.	3	3	Mary, D.	8	8
Born, E.	24	254	Meek, J. W.	32	178
Buckstaff, R. N.	10	11	Melville, E. C.	11	15
Cain, C. V.	1	2	Mielke, H.	16	69
Chandra, R. G.	73	93	Miller, W. A.	32	52
Charles, D. F.	10	12	Morrisby, A. G. F.	8	36
Cobb, H.	3	5	Motley, G.	29	46
Costello, R. B.	9	9	Oravec, E. G.	71	182
Cragg, T.	122	124	O'Sullivan, W.	21	49
Darling, B.	20	44	Parker, P. O.	40	40
Darnell, P.	1	4	Pearcy, R. E.	5	5
Darsenius, G.	7	21	Peltier, L. C.	38	129
Diedrich, DeL.	2	4	Penhallow, W.	5	5
Diedrich, G.	4	10	Peter, H.	39	259
Domke, K.	27	229	Pohl, E.	17	119
Escalante, F. J.	96	143	Renner, C. J.	111	111
Estremadoyro, V. A.	10	13	Rick, L.	1	1
Fernald, C. F.	143	205	Rosebrugh, D. W.	20	93
Fernald, E. S.	2	2	Schulte, D.	13	13
Ford, C. B.	14	14	Segers, C.	22	139
Galbraith, W. H.	39	111	Sill, E. A.	17	17
Garneau, DeL.	11	11	Snow, D.	4	4
Greenley, R. M.	69	155	Sofronijewitsch, D.	24	185
Hartmann, F.	130	130	Taboada, D.	103	104
Hiett, L.	19	38	Tarwater, C.	35	101
Howarth, M.	20	20	Venter, S. C.	22	26
Jerabek, H. S.	5	8	Weber, J. A.	23	23
Kato, H.	24	34	Wells, K. A.	2	2
Kelly, F. J.	12	12	Whitehill, S. L.	3	3
Knowles, J.	14	17			
de Kock, R. P.	109	580	66	Totals	4,866

Nova Search. Nova Search reports were received during April from 16 observers, as follows:

Observer	Area	Nights	Mag.	Observer	Area	Nights	Mag.
Adams, R. M.	33, 34, 53,				56	3	6
	54, 65, 66	3	8		56	2	5
	33, 34	1	6	**Milton, E.	46	1	6
	53, 54, 71, 72	2	6	**Morgan, F.	34	10	6
	65, 66	3	6	**Noseworthy, T.	82	9	6
	71, 72	4	8	*Rick, L.	Dome	7	1
**Birtles, B.	81	3	6		18, 65	7	4
**Cockhill, B.	51	3	6	Rosebrugh, D. W.	Dome	8	3
**DeKinder, F.	36	11	8		1	1	4
*Diedrich, DeL.	94	3	5		14	8	4
	94	1	4	Smith, F. W.	3, 4	4	6
*Diedrich, G.	Dome	4	2	Wells, K. A.	33-37, 49-54,		
	Dome	1	1				

Courtesy Maria Mitchell Observatory • Provided by the NASA Astrophysics Data System

Table 5. Photocopy of the list of observations on Variable Stars during April 1951 by Chandra

6 Recognition from AAVSO

Apart from tendering appreciation from time to time for his outstanding work in estimations of variables, Chandra was accorded some rare distinction by the AAVSO. In connection to this we would like to quote here from the *Centenial History of the American Association of Variable Star Observers*, [Williams & Saladyga 2011]:

“The case of Radha G. Chandra of Bagchar, Jessore, India, illustrates a growing international influence in this period. A clerk in the tax collector’s office by day, he enjoyed watching the stars at night. When Chandra made an independent discovery of Nova Aquila 1918 and reported his results to HCO, Campbell recommended him as a member of the AAVSO.”

On one such occasion, in 1932, Campbell intimated him that he was relieved from paying annual subscription to the ‘Association’ in the following words [Campbell 1941]:

“In view of the splendid record which you . . . have made during the past years in connection with variable star observing and in view of the fact a good friend of the Association decided to defray the annual dues ...”.

The most prestigious reward was his election as a honorary member of the AAVSO at its Annual Meeting in 1947 at Harvard. This news was reported in the *Sky and Telescope* [Hoffleit 1947] in the following manner:

“Two outstanding observers were elected to honorary membership: Rev. T. C. Bouton, St Petersburg, Fla, and R. G. Chandra of Bagchar, India.”

In connection to the opportunity for international involvement, the AAVSO Council, held in November 1920, gave extraordinary importance and recognition to Chandra. The available Record [Williams & Saladyga 2011] on this matter is like this:

“... the Council considered a suggestion from Indian member and regular contributor R.G. Chandra that the AAVSO undertake a statistical analysis of its observations database on a regular basis but concluded that the financial resources available would not permit such an undertaking”.

Another remark can be quoted here as made in a letter, dated 12 December 1950, by Harlow Shapley, Director of the Harvard College Observatory [Chakrabarty 1994]:

“The American Association of Variable Star Observers, with Head-quarters at the Harvard Observatory, is honored to salute you as one of its important contributors from abroad.”

7 Conclusion

Though, the academic attainment of Chandra was not conspicuous, yet by dint of his determination and dexterity he achieved the distinction of becoming one of the best observer astronomers among his contemporary amateurs in the world. In the series of Harvard radio talks broadcast from the station WRUL, Leon Campbell as Recorder of the AAVSO, appropriately narrated on 8 March 1941, about the amateur astronomer like Chandra and specially mentioned his rich contribution as an observer,

in the following lines [Campbell 1941]:

“By amateur astronomer we mean one who makes astronomy his hobby, or avocation, rather than his vocation. He it is who observes the stars for the love and the thrill of the thing; and he surely finds plenty of thrills, whether in snow-covered yards in a New England city, the wide expanses of our Middle-West, or in more salubrious climates of Italy and India. He it is who drag out his telescope each clear evening to see “what’s up” in variable star activities, and to note if a particular star had faded considerably in light since the last time he looked, or if another star suddenly increased in brightness since last night, or perhaps this particular amateur, variable star observer has had erected in a shelter atop his home, or in his back yard, a more pretentious telescope, fitted with setting circles and electric clock-drive with which he can turn upon a pet variable star and find the special star right there in the center of the field of view.

... In foreign countries we have Radha G. Chandra, Customs Official of Bagchar, India. Mr. Chandra, now in his sixtieth year, who has been aiding in the variable star work since 1919, has accumulated probably more observations on variable stars than any other A.A.V.S.O. foreign observer, well over 50,000.”

At the fag-end of his of his career as an observer Chandra received the following felicitation from Harlow Shapley, then Director of the Harvard College Observatory [Chakrabarty 1999]:

*HARVARD COLLEGE OBSERVATORY
CAMBRIDGE 38, MASSACHUSETTS*

“Dear Mr.Chandra,

December 12, 1950

The American Association of Variable Star Observers, with headquarters at the Harvard Observatory, is honored to salute you as one of its important contributors from abroad. On the occasion of the thirty-ninth annual meeting we of the Association and of the Harvard Observatory joined in recognizing that astronomical work such as you accomplish is a significant contribution in the cause of international good-will and cooperation. From seventeen different countries come the systematic measures of the Sun and the variable stars that are of supra-national interest to all of us; we are in a sense, a Stella United Nations.

We wish you continued success in you work during this fortieth year of the Association, and hope that in this modest enterprize of ours we are providing an example of cooperation. The members of the AAVSO are showing how the people the world over can substitute for strife and suspicion this intellectual and technical collaboration and how we can build the scientific friendship that are essential for a continued civilization.”

There are some other letters² written by AAVSO personnel, e.g. Campbell, Fisher etc. time to time to Chandra which reveal the fact that the relationship between them was not only official based on astronomical observations but also very cordial and friendly.

² See the photocopies in the Ref. [Biswas et al. 2011a]

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